



Nanotechnology in Undergraduate Education

NSEE Workshop

Michael Clarke, NSF

- Program Announcement

www.nsf.gov/pubs/2003/nsf03044/nsf03044.htm

- 2002 NUE Workshop Report

www.nanofab.psu.edu/education/nsf-nue-program.htm

- NSF Nano Website

www.nsf.gov/nano



National Nanotechnology R&D

H.R. 766 Passed in the House and Referred to Senate, May 8, 2003

- Sec. 3. b.(3). expand education and training of undergraduate and graduate students in interdisciplinary nanotechnology science and engineering;
- Sec. 3. b.(5) ensure that societal and ethical concerns, including environmental concerns and the potential implications of human performance enhancement and the possible development of nonhuman intelligence, will be addressed as the technology is developed.



Nanoscale Science & Engineering (NSE, NSF 03-043)

- NSE Centers (NSECS)
- Nanotechnology Integrated Research Teams (NIRTS)
- Nanotechnology Exploratory Research (NER)
- Nanotechnology in Undergraduate Education (NUE)



Nanoscale Science & Engineering Education (NSEE, NSF 03-044)

- Centers for Learning and Teaching (NCLT)
- Informal Science Education (NISE)
- Instructional Materials Development (NIMD)
- Nanotechnology in Undergraduate Education (NUE)



NUE

- Integrate nanoscale science and engineering into curricula with emphasis on:
 - first- and second-year
 - new approaches to undergraduate education through interdisciplinary collaborations
- Introductory undergraduate STEM courses
- Teaching modules – lecture, lab, software, *etc.*
- Incorporating undergraduate research opportunities based on nanoscale science and engineering into the curriculum
- A diversity of other approaches.



Additional Criteria

- the extent to which creative, interdisciplinary approaches to nanotechnology undergraduate education are fostered;
- the likelihood that the project will engage students and faculty at participating institutions (and, if applicable, elsewhere) in undergraduate nanotechnology education;
- soundness of plans for project assessment, institutionalization, and dissemination beyond the faculty members involved in the proposal;
- potential impact on developing a diverse workforce and enhancing science literacy; and
- the scale of the potential impact.



NUE Statistics FY03

- 80 proposals from 30 states
 - 2 from community colleges
 - 28 from four-year colleges
 - 50 from research universities
- Success rate was statistically the same across college categories and panels



Nanotechnology, An Active Learning Experience for Undergraduates

Miguel Castro, U. Puerto Rico – Mayaguez

NUE-304348



Integrating research into the curriculum, undergraduates developed a one-step-two-reactant approach to the synthesis of nearly mono disperse silver nanowires based on wet chemical methods.

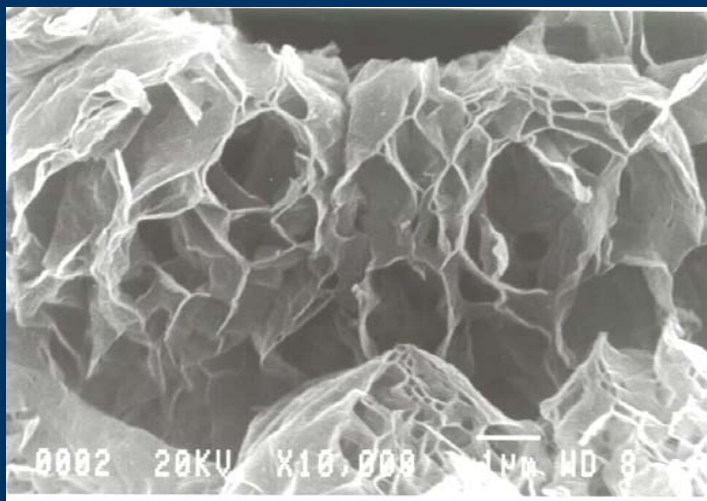
Scanning electron microscopy reveals that the selectivity for nanowires over nanospheres is 100 %. The nanowires are about 200 nm in diameter and 2500 nm long.



Nanotechnology Across The Undergraduate Chemistry Curriculum

Tom Manning, Valdosta State U.

NUE-0303668



In new exploratory laboratories, students synthesize and trap the single molecule magnet, Mn_{12} , inside a variety of matrices, such as single walled nanotubes and exfoliated graphite (shown in picture) in order to observe shifts in fundamental

magnetochemistry properties in nanometer sized particles.

Faculty and staff at the National High Field Magnet Lab work with the students to provide SQUID and TEM measurements.



Changes in FY04

- Two-year awards for a total of \$100,000.
- Second proposal accepted if focused on the societal, ethical, economic and/or environmental implications of nanoscale science and technology
- Increased emphasis on evaluation



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